(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
7 June 2001 (07.06.2001)

PCT

(10) International Publication Number
WO 01/39707 A1

(51) International Patent Classification[7]: A61F 13/15

(21) International Application Number: PCT/EP99/09490

(22) International Filing Date: 3 December 1999 (03.12.1999)

(25) Filing Language: English

(26) Publication Language: English

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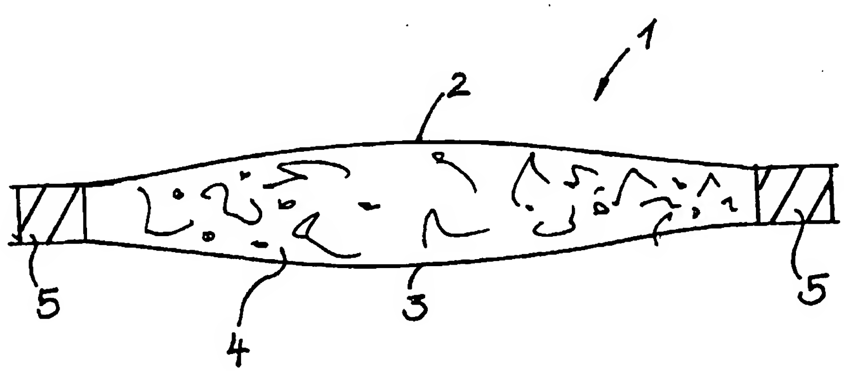
(81) Designated States *(national)*: AE, AL, AM, AU, AZ, BA, BB, BG, BR, BY, CA, CN, CU, CZ, EE, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, RO, RU, SD, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published:
— *With international search report.*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

(54) Title: INTERMEDIATE ABSORBENT STRUCTURE WITH INTEGRATED PARTICLE BARRIER



(57) **Abstract:** The invention relates to an intermediate absorbent structure compsising an upper layer that is liquid permeable, a lower layer that is impervious to the penetration of particles of absorbent material or odor absorbing material in the form of particles or small fibers, said layer having a mean pore size in the range 5-25 μm, wherein at least 70 % of the pores have a diameter in the range 5-15 μm, and an intermediate layer comprising absorbent material, preferably superabsorbent polymer in the form of particles or small fibers, between said upper layer and said lower layer, wherein said lower layer has an air permeability less than 1000 m/s at 196 Pa, a tensile strength in the machine direction of at least 20 N/5 cm and a tensile strength in the cross direction of at least 10 N/5 cm. Preferred embodiments include structures where said lower layer comprises continuous filaments and fine fibers.

WO 01/39707 A1

Intermediate Absorbent Structure with Integrated Particle Barrier

This invention relates to intermediate absorbent structures comprising an upper layer that is liquid permeable, a lower layer and an intermediate layer arranged between said upper layer and said lower layer, said intermediate layer comprising absorbent material preferably comprising superabsorbent polymer in the form of particles or small fibers dispersed between said upper layer and said lower layer, and optionally comprising a thermoplastic bonding agent, wherein said absorbent core is produced as part of a continuous web of absorbent cores, wherein the width of said continuous web is approximately equivalent to the width of a multiple number of cores, wherein said absorbent material is deposited in a defined pattern, as defined in the preamble of patent claim 1.

Intermediate absorbent structures as defined in the preamble of claim 1 are known from EP 0 708 628 B1. Intermediate absorbent structures of this type serve to provide, by means of an off-line process, intermediate multilayer absorbent struc-

tures and products, incorporating powders or fibers or granules of absorbent material, which products may also be of small size, with a maximum design flexibility and without appreciable additional costs from modifying the shape or the structure of the absorbent article.

Although intermediate absorbent structures known from EP 0 708 628 B1 do have a number of advantages, it has, however, being found that they do have also some disadvantages and shortcomings.

For better understanding of the invention, as used herein, the term "absorbent structure" refers to disposable absorbent articles for personal or medical care, such as catamenial devices, incontinence devices, diapers, dressings and the like. They may also be used for household or industrial applications, such as cleaning devices. Intermediate absorbent structures are manufactured in the form of a continuous web that can be converted into absorbent articles. In final absorbent articles, said absorbent structures are often covered by an external covering material.

Common elements in disposable absorbent articles such as catamenial devices, incontinence devices, disposable diapers, dressings and the like include a fluid permeable surface material to be placed adjacent to the site of fluid discharge, a fluid storage core, and a fluid impervious surface external to the storage core for fluid containment. A variety of forms and configurations of absorbent materials in storage cores, often including fibrous materials, in absorbent articles are

known in the art. Storage cores typically include superabsorbent materials in the form of particles, powder, granules or fibers due to the excellent absorption and storage capabilities of these materials. Typically the size of the particles in a powder material is in a range of 40 to 1400 μm, whereas above such upper limit, they are more appropriately referred to as granules. For the purpose of this application, powder and granules will be included in the term particles. Other particles or fibers with a function such as odor absorption or treatment may also be present in the core.

As the core of an absorbent article is intended to permit liquid entry and storage, the arrangement of materials inside the core is designed to allow fluid flow to the absorbent particles or fibers. A difficulty in using such absorbent materials in a typical absorbent article is the migration and loss of absorbent material. Migration and inappropriate local concentration of absorbent material can lead to diminished article effectiveness. Penetration of superabsorbent material to an external layer of a final article can have a particularly negative impact on both the esthetic aspects of a finished article, for example on the outward-facing portion of a diaper or a wound dressing, and on the containment function of the article. Lost absorbent material can result in extra manufacturing and handling measures to cope with and recuperate lost material, the need to overdose the quantity of absorbent material to compensate for loss, a negative esthetic appearance of the article and diminished effectiveness of the article. This problem is particularly relevant with regard to intermediate absorbent products that are intended to be in-

cluded in final absorbent articles. Said intermediate products are commonly manufactured as continuous webs to be rolled, and later separated into individual intermediate articles to be used as at least part of the storage core of final articles.

Due to the risk of migration and loss, said absorbent particles or fibers require substantial gluing or creation of adhesion points within the core. However, glues and adhesives are each known to reduce the absorption capability of absorbent materials. Common approaches to solving this dilemma include the addition of an excessive amount of absorbent material to the core, and decreasing the amount of glue or adhesive used in the core to a level where it does not interfere with the absorbent materials. The latter approach is preferable as it requires a lower quantity of raw materials, however an obvious result of a decrease in the quantity of adhesive is an increase in the quantity of loose absorbent material.

A number of solutions to the problem of absorbent material loss through the longitudinal and transverse edges of absorbent cores have been disclosed, particularly with reference to intermediate absorbent articles, as for example in European Pat. Appl. No. 846455 to Corzani et al. Particle loss through the topsheet of final articles has been addressed in, for example, European Pat. Appl. No. 749736 to Divo et al. or European Pat. Appl. No. 682927 to Bitowft et al. Such a topsheet may comprise the core supporting material or upper core material used in the manufacture of intermediate articles. More

complex approaches to particle loss from the entire article that involve wrapping the absorbent core in a particle containment material have been disclosed in, for example, US Pat. No. 5,458,592 to O'Brien et al. or WO 97/07761 to Veith et al.

It is an object of the present invention to provide an intermediate absorbent structure which overcomes the aforementioned shortcomings and disadvantages; which may be produced at minimum costs and which supports and improves the characteristics of the final absorbent product.

These objects are accomplished by the invention thanks to the features of the characterising portion of claim 1. Other advantages and practical features are the subjects of the dependent claims.

According to the invention, an intermediate absorbent structure as defined in the preamble of claim 1 is characterised in that the lower layer is impervious to the penetration of particles of the absorbent material or odor regulating material in the form of particles or small fibers, said layer having a mean pore size in the range 5 - 25 µm, wherein at least 70 % of the pores have a diameter in the range 5 - 15 µm, and wherein said lower layer has an air permeability less than 1000 m/sec at 196 Pa, tensile strength in the machine direction of at least 20 N/5 cm and a tensile strength in the cross direction of at least 5 N/5 cm.

In other words, the problems of the prior art are solved by a lower layer consisting of a material which can't be penetrated by particles of the absorbent material. This material may be a synthetic film, a nonwoven or a film-nonwoven composite.

Surprisingly, a number of advantages may be achieved by using materials as defined in the characterising portion of claim 1 in the lower layer. As the lower layer prevents penetration of particles of the absorbent material, the backsheet material or an external covering of the final product may now be made of less expensive materials and of materials having better characteristics for the user, respectively.

Another advantage of the invention is the avoidance of loss and migration of the expensive absorbent material during the off-line production of the intermediate absorbent structure according to the invention.

This type of barrier also has the advantage of being fluid permeable, but nonabsorbing, to permit passage and absorption of liquids that bypass the absorbent core upon discharge, and thereby reducing fluid contact with the backsheet or external covering of the final article.

Other objects and features of the present invention will become apparent from the depending claims and from the following detailed description describing a preferred embodiment of the invention. It should be understood, however, that the description is not a definition of the limits of the invention.

A layered intermediate absorbent structure comprising a breathable barrier composite according to the invention will be produced according to the teachings of EP 0 708 628 B1, incorporated herein in its entirety by reference.

At least a lower layer of the absorbent structure according to the invention is impervious to the penetration of particles of absorbent material or odor absorbing material in the form of particles or small fibers. Said layer has a mean pore size preferably in the range 5-25 μm, wherein at least 70 % of the pores have a diameter in the range 5-15 μm. Pore size can be measured using a standard light microscope. Preferably at least 10 random areas of dimensions 1 mm x 1 mm are selected at random from a given sample for measurement. The diameters of the pores within the given areas are measured using a magnification of 80x and a suitable image analysis system, for example a Quantimet Image Analysis System.

Said lower layer preferably has an air permeability less than 1000 m/s at 196 Pa, as measured according to Edana RTM 140.1-99 for Nonwovens Air Permeability amended such that the pressure drop is 196 Pa (as in Edana RTM 140.1-81) instead of 200 Pa.

The lower layer preferably has a tensile strength in the machine direction of at least 20 N/5 cm and a tensile strength in the cross direction of at least 5 N/5 cm measured according to Edana RTM 20.2-89.

The intermediate absorbent structure or absorbent core is produced as part of a continuous web of cores as described in EP 0 708 628 B1.

The sequence of intermediate structure formation generally proceeds starting with a web of either the so-called upper layer, or the lower layer used as a supporting layer for the depositing of a layer comprising absorbent material. In one embodiment of the invention the intermediate absorbent article may comprise more than one liquid permeable layer and more than one layer of absorbent material.

The liquid permeable upper layer is selected from the group woven fabric, nonwoven fabric, synthetic film, tissue paper, air-laid paper, air-laid composites, and composites of fine fibers and continuous filaments. In one embodiment, the upper layer comprises cellulose fibers with a basis weight in the range 20 to 500 g/m^2. Basis weight can be evaluated according to the Edana RTM 40.3-90 for Nonwovens Mass per Unit Area. Alternatively, the material of the upper layer may comprise 50-100 % cellulose. Furthermore, the upper layer may comprise at least 1% synthetic materials selected from the group polyolefins, polypropylene, polyethylene, polyamides, polyesters and polyetheresters. In a preferred embodiment the upper layer is a layer of air-laid paper. Said layer may be formed in-line and said layer may include stiffening agents, such as for example chemically stiffened pulp, for resiliency and form maintenance.

The layer of absorbent material comprises material selected from the group absorbent gelling material, absorbent particles, superabsorbent particles, absorbent fibers and superabsorbent fibers. The absorbent material can be either a single absorbent material or a blend of absorbent materials, comprising material that is capable of turning into a gel upon being wetted, and thus retaining large amounts of liquids with respect to its own original volume. Preferred materials in this respect are so-called superabsorbent polymers or SAP, in the form of particles, powders or fibers, however, according to the invention other known absorbent materials can be used, both in powder and fiber form. A variety of such materials are known to the art.

In a preferred embodiment, said layer comprises superabsorbent gelling material in the form of particles. In addition, the absorbent material may comprise material with an odor absorbing or odor controlling function such as, for example, zeolites, silica, carbon or pH-regulating material. The basis weight of the deposited absorbent material, measured in the product and with respect to the deposited areas, is preferably from 10 to 1000 g/m^2.

Said absorbent material may be deposited as a single layer or as multiple layers between the upper and lower layers of the article. Alternative to the deposition of absorbent material in between containing layers, an absorbent composite may be formed by the mixing of absorbent material with accompanying supporting fibers comprising natural or synthetic fibers, and

optionally including bicomponent binder fibers, as may be formed using conventional air laid technology.

In a preferred embodiment of the invention, the lower layer comprises a composite of fine fibers and continuous filaments with a total basis weight of fine fibers in the range 2 to 40 g/m^2, and a total basis weight of continuous filaments in the range 8 to 48 g/m^2. The production of such composites is well described in the art. Most preferably, said composite of fine fibers and continuous filaments comprises a spunbond-meltblown composite with a spunbond layer with a basis weight in the range 4 to 24 g/m^2 and a meltblown layer with a basis weight in the range 2 to 20 g/m^2. Alternative composite compositions are a spunbond layer with a basis weight in the range 10 to 20 g/m^2 and a meltblown layer with a basis weight in the range 2 to 12 g/m^2, or a spunbond layer with a basis weight in the range 2 to 9 g/m^2 and a meltblown layer with a basis weight in the range 1 to 2 g/m^2. In an additional embodiment, the composite of fine fibers and continuous filaments comprises at least one spunbond layer and at least one meltblown layer. The material of the lower layer is selected from the group polyolefins, polypropylene, polyethylene, polyamides, polyesters and polyetheresters, most preferably from the group polyethylene and polypropylene.

The formation of simple spunbond-meltblown composites is known to the art. In a preferred embodiment, the spunbond-meltblown composite of the lower layer is manufactured using a forming line that comprises at least one station for the melt extrusion of continuous filaments and at least one sta-

tion for the melt extrusion of fine fibers. The line preferably comprises one continuous filament station and one fine fiber station, the fine fiber station preferably lying downline from the continuous filament station. In the case of a simple two-layer composite, the continuous filaments are formed by the extrusion of molten polymer through spinnerets followed by the drawing of the filaments and the depositing of the filaments in a random fashion on a moving belt. Fine fibers produced by the meltblown technique are then deposited onto the continuous filament layer in a random fashion. Downline of the extrusion stations, the composite is intermittently bonded using a heated calender. Rolling and possibly slitting of the composite may follow bonding.

The material forming the adhesive strips can be a so called hot melt comprising various materials, such as APP, SBS, SEBS, SIS, EVA and the like, or a cold glue, such as a dispersion of various materials, e.g. SBS, natural rubber and the like, or even a solvent-based or a two-component adhesive system. Furthermore, the material may be capable of cross-linking to form specific, permanent chemical bonds with the various layers. The amount of adhesive is a function of the type of adhesive used, however it is generally between 0.2 and 20 g/m.

The rolled intermediate product webs are preferably unrolled, slit into continuous webs the width of a single absorbent core, and festooned. The web is preferably festooned into firm packaging, but may also be festooned into soft, com-

pressible packaging or onto pallets. Alternatively, the web may be festooned in-line with or without prior slitting.

An illustrative embodiment of the invention is shown in the attached drawing, which is an enlarged cross-section of an example of the invention.

In the drawing is shown a non-limiting example of an intermediate absorbent structure 1 comprising an upper layer 2 and a lower layer 3 and an intermediate layer 4. Said intermediate layer 4 is closely enveloped in between the upper layer 2 and the lower layer 3.

Upper layer 2 and lower layer 3 are bonded together by adhesive strips 5.

The physical properties of lower layer 3 are differing from the physical properties of upper layer 2, as described above.

Those skilled in the art will recognize that the absorbent core with integrated particle barrier of this invention may be used in a variety of final absorbent articles comprising particles or small fibers, such as for example catamenial pads, diapers, incontinence devices, wound dressings and in other applications not disclosed in the preceding description.

Claims

1. An intermediate absorbent structure comprising
a) an upper layer that is liquid permeable,
b) a lower layer and
c) an intermediate layer arranged between said upper layer and said lower layer, said intermediate layer comprising absorbent material preferably comprising superabsorbent polymer in the form of particles or small fibers dispers between said upper layer and said lower layer, and optionally comprising a thermoplastic bonding agent, wherein said absorbent core is produced as part of a continuous web of absorbent cores, wherein the width of said continuous web is approximately equivalent to the width of a multiple number of cores, wherein said absorbent material is deposited in a defined pattern, characterized in that the lower layer is impervious to the penetration of particles of absorbent material or odor regulating material in the form of particles or small fibers, said layer having a mean pore size in the range 5-25 μm, wherein at least 70 % of the pores have a diameter in the range 5-15 μm, and in that said lower layer has an air per-

meability less than 1000 m/s at 196 Pa, a tensile strength in the machine direction of at least 20 N/5 cm and a tensile strength in the cross direction of at least 5 N/5 cm.

2. The continuous web of cores of claim 1 comprising individual cores of width in the range 20-2000 mm.

3. The continuous web of cores of claim 1 wherein the width of said web is approximately equivalent to the width of a single core.

4. The upper layer of claim 1 selected from the group of woven fabric, nonwoven fabric, synthetic film, tissue paper, air-laid paper, air-laid composites, and composites of fine fibers and continuous filaments.

5. The lower layer of claim 1 comprising a hydrophilic additive.

6. The lower layer of claim 1 preferably comprising a composite of fine fibers and continuous filaments.

7. The composite of fine fibers and continuous filaments of claim 6 with a basis weight of fine fibers in the range 2 to 40 g/m^2, and a total basis weight of continuous filaments in the range 8 to 48 g/m^2.

8. The composite of fine fibers and continuous filaments of claim 6 comprising a spunbond-meltblown composite.

9. The composite of claim 6 wherein the basis weight of continuous filaments is about 4-24 g/m² and the basis weight of fine fibers is about 2-20 g/m².

10. The composite of claim 6 comprising a spunbond layer with a basis weight in the range 10 to 20 g/m² and a meltblown layer with a basis weight in the range 2 to 12 g/m².

11. The composite of claim 6 comprising a spunbond layer with a basis weight in the range 2 to 9 g/m² and a meltblown layer with a basis weight in the range 1 to 2 g/m².

12. The composite of claim 6 comprising at least one spunbond layer and at least one meltblown layer.

13. The intermediate layer of absorbent material of claim 1 comprising absorbent material selected from the group absorbent gelling material, superabsorbent particles and superabsorbent fibers.

14. The intermediate layer of absorbent material of claim 1 comprising odor regulating material selected from the group zeolites, silica, clay, carbon and pH regulating compounds.

15. The upper layer and the intermediate layer of absorbent material of claim 1 bonded together thermally, optionally with the use of steam.

16. The lower layer and the intermediate layer of absorbent material of claim 1 bonded together at discrete points, op-

tionally using a thermally activated thermoplastic polymer or a pressure sensitive adhesive.

17. The thermoplastic polymer in claim 16 selected from the group polyolefins, polypropylene, polyethylene, and ethylene vinyl acetate.

18. The integrated absorbent core of claim 1 comprising more than one liquid permeable layer and more than one layer of absorbent material.

19. The upper layer of claim 1 comprising cellulose fibers with a basis weight in the range 20-1000 g/m^2, preferably in the range 20-500 g/m^2.

20. The material of the upper layer of claim 1 comprising 50-100 % cellulose.

21. The upper layer of claim 1 comprising at least 1% synthetic materials selected from the group polyolefins, polypropylene, polyethylene, polyamides, polyesters and polyetheresters.

22. The material of the lower layer of claim 1 selected from the group polyolefins, polypropylene, polyethylene, polyamides, polyesters and polyetheresters.

23. A final absorbent article comprising the absorbent core with integrated barrier of claim 1.

24. A final absorbent article comprising the absorbent core with integrated barrier of claim 15.

25. The manufacture of the web of cores of claim 1 comprising a step wherein said web is slit longitudinally.

26. The manufacture of the web of cores of claim 1 comprising a step wherein said web is slit longitudinally.

27. The manufacture of the web of cores of claim 1 comprising a step wherein said web is cut transversely.

28. The manufacture of the web of cores of claim 1 comprising a step wherein said web is trimmed.

29. The manufacture of the web of cores of claim 1 comprising a festooning step.

30. The converting of the web of cores of claim 1 into a final absorbent article comprising a festooning step.

31. A process for the manufacture of intermediate absorbent products comprising the steps:
a) optionally preparing air laid paper or air laid composite material to be used as a web-like substrate,
b) depositing absorbent material, odor controlling material, and optionally thermoplastic binder, onto a web-like substrate,
c) bonding said absorbent material and odor controlling material to the substrate, preferably with the use of heat,

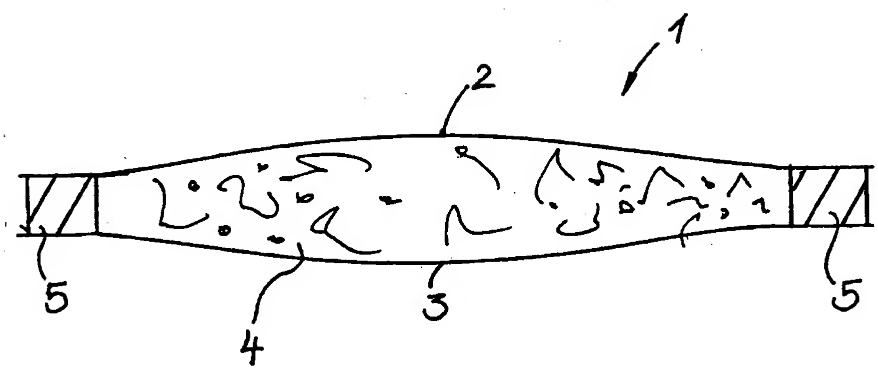
d) depositing adhesive material at least in longitudinal strips, preferably along the intended core perimeters, onto the substrate,

e) applying a further web-like sheet on top of the assembly prepared in steps (a) to (c),

f) optionally repeating one or more of the steps (a) to (e) at least once,

g) optionally longitudinally slitting the web-like composite so obtained,

h) and festooning the slit or un-slit webs.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INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP 99/09490

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 A61F13/15

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 A61F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 97 07761 A (KIMBERLY CLARK CO) 6 March 1997 (1997-03-06) cited in the application page 3, line 20 - line 35	1,4,5,22
A	page 6, line 1 - line 6 page 7, line 8 - line 19 page 8, line 3 -page 11, line 12 examples 1-9 claims 1-3,9; figures 1,4-6,8	14-17
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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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Date of the actual completion of the international search	Date of mailing of the international search report
17 May 2000	24/05/2000

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X	GB 2 269 109 A (KAO CORP) 2 February 1994 (1994-02-02) page 17, line 21 -page 22, line 8 page 22, line 24 -page 25, line 17 page 32; table 1 claims 1-3; figures 1-3,11-17 ---	1,4, 19-24
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A	column 13, line 17 - line 40 column 15, line 7 -column 16, line 49 column 20, line 48 -column 23, line 14 figures 1-6 ---	6,19-21
X	US 5 334 177 A (COHEN RICHMOND R) 2 August 1994 (1994-08-02) column 2, line 25 - line 45 column 2, line 64 -column 3, line 31 column 4, line 21 - line 64 column 5, line 11 - line 21 column 5, line 56 - line 63 column 6, line 1 - line 60 column 7, line 33 - line 40 column 8, line 3 - line 16 claims 1,5,8,9,11-14,16,18-20,22,23,25,32,33,35,40-44,47; figures 1-7 ---	1,4,6, 20-24
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INTERNATIONAL SEARCH REPORT

In ational Application No
PCT/EP 99/09490

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/EP 99/09490

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